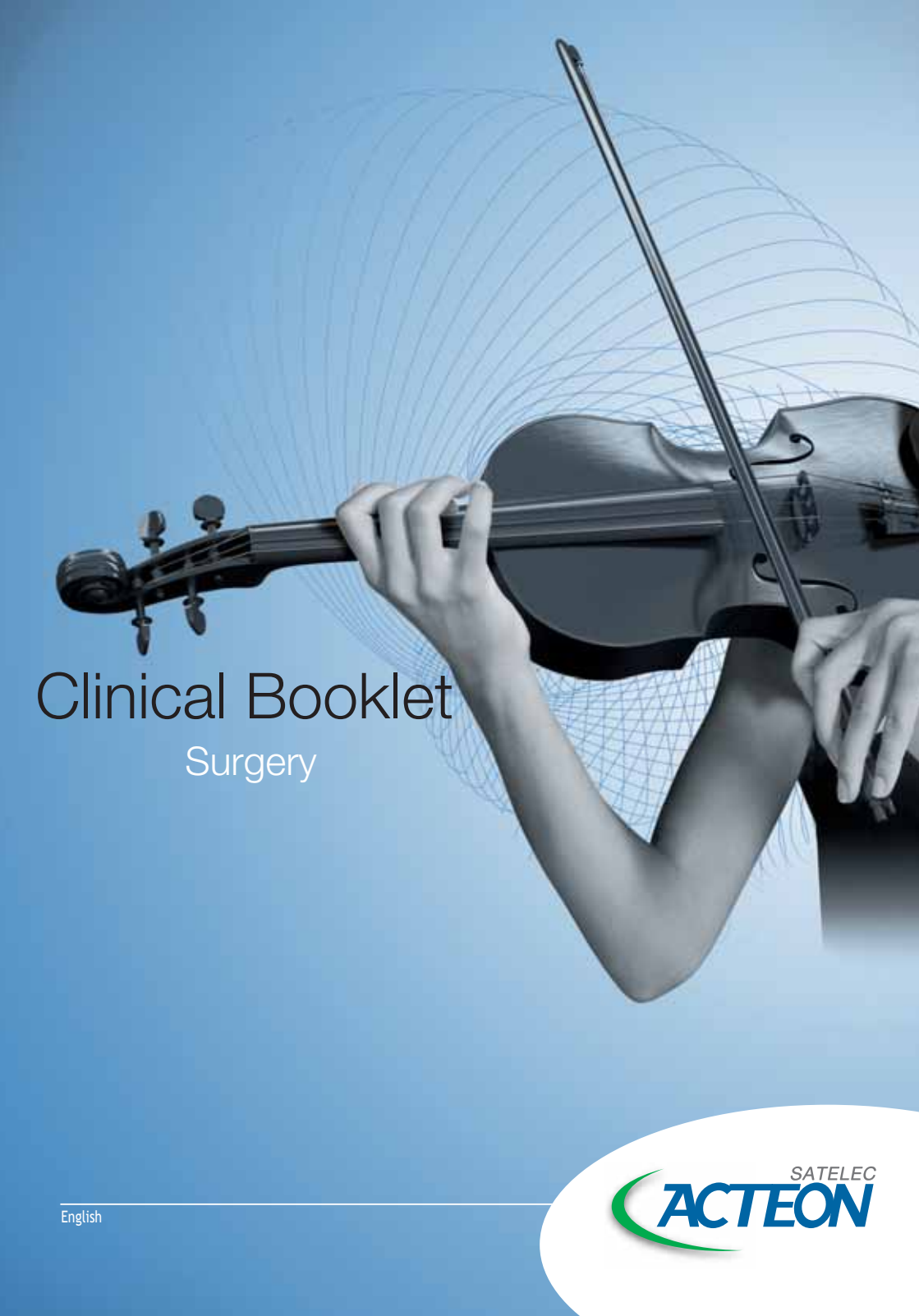

Clinical Booklet

Surgery

English

SATELEC ACTEON

Power ultrasonics for

➜ **Safety:** Preservation of soft tissue.
➜ **Speed:** A fast, precise and effortless selective cut thanks to ultra-sharp, robust and resistant tips.
➜ **Comfort:** Atraumatic treatments (no bone loss or bleeding), fast healing and greatly reduced post-operative pain.

PIEZOTOME
Piezo.Ultrasonic.Surgery.Unit

PIEZOTOME SOLOLED
Piezo.Ultrasonic.Surgery.Unit

bone surgery by Satelec®

- ➜ **More power:** up to three times more powerful in Piezotome mode (up to 60W) on Piezotome 2, Solo (LED), Implant Center 2.
- ➜ **New light function:** the Piezotome 2 and Newtron handpieces are equipped with very high power LEDs (100,000 Lux).
- ➜ **Finely adjusted power:** thanks to the progressiveness of ultrasonics (on Piezotome 2 and Implant Center 2).
- ➜ **A wide touch-sensitive screen:** easier navigation and programming (on Piezotome 2 and Implant Center 2).

PIEZOTOME 2
Piezo.Ultrasonic.Surgery.Unit

IMPLANTCENTER 2
Piezo • Ultrasonic • Surgery & Implantology Unit

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Our protocols, and the findings that support them, originate from university theses and international publications, which you will find referenced in the bibliography. We have of course gained tremendous experience over the last thirty years from the dentists worldwide who, through their recommendations and advice, have contributed to the improvement of our products.
But our special thanks go to each SATELEC user who shows faith in us, each time they choose one of our products.

Gilles Pierson
President

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Synthesis

➜ MORE SAFETY

Selective cutting
A selective cut (distinction between hard and soft tissues): only the bone is cut; no risk of injuring soft tissues (nerves, membranes, arteries).

Controlled irrigation for great bone healing
The two peristaltic pumps (with integrated cassette) offer accurate control and extremely precise irrigation to avoid any heating, resulting in better bone healing and absence of postoperative effects such as edema and pain (10).
According to Dr. Harder's clinical study (5): "The Piezotome produced the smallest increase in intraosseous temperature".

➜ MORE PRECISION

Very fine
A clean, narrow and regular cut to retain maximum bone volume. Particularly robust, SATELEC tips are also adapted to each anatomical context.

Visibility of the operative field
The hemostatic effect of cavitation (spray) improves the visibility of the operative field.

Tactile sense
The Newtron technology that drives the handpiece by "Cruise Control®" guarantees gentle, regular and controlled vibrations of the SATELEC tips, allowing continuous action, even on deep cuts.

➜ MORE COMFORT

Reliability
Piezotome / Piezotome Solo (LED) / Piezotome 2 / Implant Center 2 are reliable, powerful and silent devices.

Temperature control
No overheating of the handpiece or tips.

Efficiency of ultrasonics
Cuts are made without any effort or pressure. Only a back and forth movement is needed.

➜ PRINCIPLES

An efficient use of SATELEC ultrasonic tips

1. **The active part**, in contact with the surface, is generally located on the last 2-3 millimeters of the tips.
2. **Paintbrush movement:** ultrasonics, piloted by the NEWTRON™ technology require no pressure to be effective. A so-called "paintbrush" movement, where smoothness and dexterity are preferred to obtain the desired atraumatic result.
3. **Selective cut:** the undeniable advantage of ultrasonic cutting is soft tissue preservation.

➜ MAIN CHARACTERISTICS OF ULTRASONIC POWER GENERATORS

PIEZOTOME / PIEZOTOME 2 / IMPLANT CENTER 2

- Two ultrasonic functioning modes : PIEZOTOME is intended for pre-implant bone surgery and NEWTRON for conventional tooth treatments.
- Automatic recognition of the connected handpiece: **NEWTRON** or **PIEZOTOME.**
- IMPLANT CENTER 2 has an integrated I-SURGE LED micro-motor.
- Two silent peristaltic pumps.
- A footswitch to control the device from a distance.

PIEZOTOME SOLO (LED)

- The best of SATELEC technology in a compact generator.
- Dedicated to ultrasonic pre-implant bone surgery.

ACTEON

Introduction

Oral surgery has long been performed with traditional equipment because oral tissue presents good healing potential (apart from certain systemic risk factors) and an absence of vital risk. However, it does have its drawbacks such as difficulty to access the operating site, heavy fatigue for the practitioner and post-op trauma for the patient.

At the present time, dental surgeons have two types of instrument available to them to perform oral surgery:
- Manual instruments;
- Motorized instruments:
  - with rotary movement,
  - with sonic or ultrasonic vibrations.

SATELEC piezoelectric generators (Piezotome / Piezotome Solo (LED) / Piezotome 2 / Implant Center 2) belong to the second category of motorized instruments with ultrasonic vibrations employing a piezoelectric transducer. They were designed with the objective to respond to the drawbacks encountered with traditional instruments and give access to such delicate operations as osteotomies, osteoplasties, ridge expansions, syndesmotomies, and sinus lift.

Until the early 90s, certain general practitioners were dissuaded from attempting implantology procedures by the risk of bone loss. Thanks to the latest technological developments, it is possible to offer patients a credible alternative. SATELEC ultrasonic power generators offer comfort, safety and precision to the practitioner during delicate operations.

This clinical booklet presents piezoelectric surgery under a technical as well as a surgical angle. It aims to guide the practitioner in the application of this recent technique by means of new protocols.

Foreword

The recommended protocols and instrument sequences described in this booklet are the fruit of our consultants' experiments, developed during clinical trials in α phase (development) and β phase (pre-launching).
It is up to each user to adapt or modify them according to the situation.

IMPORTANT:
Surgical tips designed for the first generation of Piezotome and Implant Center cannot be used with Piezotome 2 / Piezotome Solo (LED) / Implant Center 2 high power generators and vice versa.

TECHNOLOGY

SATELEC, inventor of the piezoelectric ultrasonic generator for dentistry, is entering a new era by adapting powerful ultrasonics to oral surgery.

1. Ultrasonics

Ultrasound waves have a sound frequency greater than 20,000 Hertz (vibrations per second). Humans can hear waves between 20 and 20,000 Hertz. Ultrasound is thus inaudible to humans but perceivable by certain animals such as dogs or dolphins. The use of ultrasound was developed in the 50s and is widely employed today, notably in industry and medical imaging. With the PIEZOTOME handpiece, the ultrasonic wave is transmitted to the tip by a transducer in the handpiece.

The piezoelectric ultrasonic vibrations are constituted by waves which:

- Move longitudinally;
- Move in an environment;
- Are reflected and absorbed at the interface of various encountered surfaces (17).

An ultrasonic device comprises a piezoelectric generator, driven by a footswitch, a handpiece and cord, and a choice of specific instruments according to the clinical protocol.

2. Piezoelectricity

At present, the use of piezoelectric instruments in dentistry has become common and their efficacy is demonstrated by different clinical studies.

The piezoelectric effect was discovered in 1880, by the physicists Pierre and Jacques Curie, in collaboration with Gabriel Lippmann. According to these two French researchers, the application of compressive forces on certain solid bodies would generate an electric charge. The term "Piezo" is derived from the Greek verb "piezein" which means to compress or squeeze or to press. The solid bodies that possess such a property have crystalline structures such as Quartz, Tourmaline, Seignette Salt or Baryum Titanate. Today, Quartz crystals have been abandoned and piezoelectric handpieces mainly contain ceramics of crystalline structure.

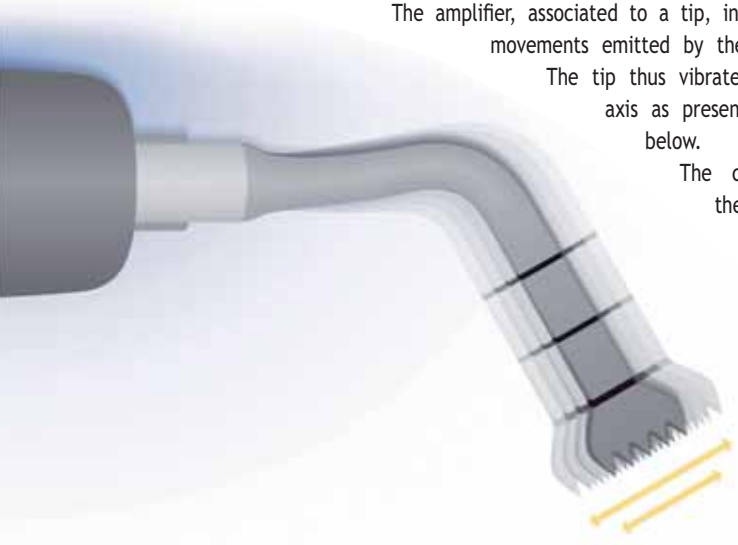
Piezo effect can be explained as:

- Direct: the properties of certain solid bodies called piezoelectric (for example, Quartz or Ceramic) to electrically polarize (movement of positive and negative charges) under the effect of a mechanical force.
- Indirect: all the deformations (expansion or contraction) of certain bodies called piezoelectric under the influence of polarization, from application of an electric field.

SATELEC piezoelectric handpieces are thus subjected to an indirect effect.

Electric current generates a deformation of piezo ceramic rings. The movement of these rings leads to vibrations in the transducer's axis. The amplifier, associated to a tip, increases the vibrational movements emitted by the piezo ceramic rings. The tip thus vibrates along a longitudinal axis as presented in the illustration below.

The counterweight deadens the vibrations to the rear and optimizes the electromechanical output.



Piloted by SP Newtron technology, the most advanced patented electronics in the market, surgical SATELEC devices benefit from several instrument control systems:

Auto-tuning System

Speed
Automatic frequency adjustement: 28-36 kHz.

The tip is always tuned into the right vibration frequency.

→ Guaranteed efficiency whatever the environment and/or treatment performed.

+

Push-Pull System

Gentleness
Controlled amplitude of the tip vibrations.

Treatments performed with smooth and painless vibrations.

→ For preservation of fragile tissues and patient comfort.

+

Feed-Back Principle

Power
Real-time power adjustment.

Power (torque) is adjusted intelligently according to the resistance met by the tip.

→ With minimum pressure, more precision and less hand fatigue.

=

Cruise Control® System

Piloted by:
Cruise Control® System

Automatic system of frequency and power regulation.

→ Stay in complete control and confidence.

3. The contribution of piezoelectric generators to oral surgery

Instruments dedicated to pre-implant surgeries are becoming more and more sophisticated. Here is a succinct analysis of various instruments sorted according to their arrival on the market (3-4).

Manual instruments remain effective but difficult to maneuver. They hinder the visibility of the practitioner. Moreover, they require a considerable physical effort on the part of the practitioner and their use remains very traumatizing for the patient. Among these instruments, the most commonly employed are scalpels, mallets and surgical osteotomes. They are still widely used in areas with easy access, but are often used in conjunction with motorized instruments.

Motorized cutting tools transform their electrical or pneumatic energy into mechanical energy, producing micro-vibrations of the bur or the bone saw. Various styles of cutting have been introduced such as circular and rectilinear movements.
Burs activated by a micromotor force the practitioner to go against the torque from the instrument rotation. Saws produce macro-vibrations which also have to be controlled by the practitioner. The cutting feature of a saw does not allow the dental surgeon to control its depth. It is thus preferable to finish this type of intervention by manual instruments in order to avoid too deep an incision which might damage soft tissues, nerves or membranes.
The use of these instruments thus remains controversial *(see tables below)*.

Bur cutting

Advantages	Disadvantages
Bur can be employed on almost all types of bone.	Cutting dependent on the force exercised by the practitioner (resulting in an increase of manual pressure).
Speed of action.	Temperature rise is more related to the pressure exercised by the practitioner than to the rotation speed (temperature harmful to the bone: 47°C for one minute) (9).
	Reduced sensitivity and precision of the practitioner due to the vibrations.
	Dangerous when used close to soft tissues, inferior alveolar nerve and sinus membrane.
	Strong torque of the instrument makes it dangerous to stop, due to its inertia.

Saw cutting

Advantages	Disadvantages
Cutting speed and linearity of the saw-cutting line.	Cutting dependent on the force exercised by the practitioner (resulting in an increase of manual pressure).
Saw can be employed on almost all types of bone.	Reduced sensitivity and precision of the practitioner due to the vibrations.
	Less control of cutting depth.
	Dangerous when used close to soft tissues, inferior alveolar nerve and sinus membrane.
	Saws cannot be employed in zones with difficult access.

Piezoelectricity

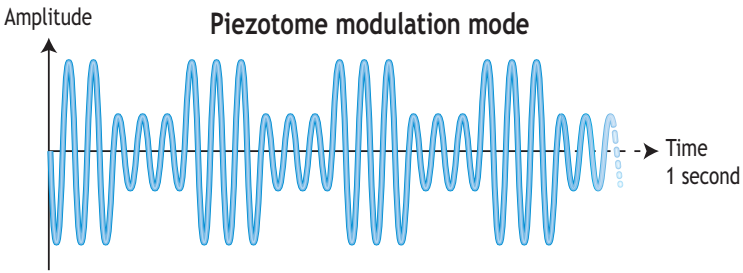
Piezoelectricity in pre-implant and periodontal surgery provides much more comfort and safety to the practitioner. Indeed, it provides **precise, fine, effortless cutting without soft tissue injury. Post-operative pain** is **minor** and **healing is fast**. Furthermore, much less effort is required to obtain a cutting line. Horton J-E et al. (7-8) have demonstrated the advantages of ultrasonic tools, such as the **precision** provided to the practitioner, the **coagulating effect** and the absence of post-operative trauma.

A comparative study performed at Harvard University by Vercellotti T. (19) compares the extent of bone healing after use of a piezoelectric instrument, a carbide bur and a diamond bur during an osteotomy and osteoplasty on a dog, on the 14th, 28th and 56th day after the procedure. At the 56th day, the sites operated with burs (carbide and diamond) showed bone loss (0.37 and 0.83mm respectively), whereas the sites operated with piezoelectricity presented bone gain of 0.45mm. This study thus proves that the piezoelectric instrument generates bone repair more favorably than burs during osteotomies and osteoplasties.

The surgical gesture required for using piezoelectric generators is different from other bone surgery techniques (for example, rotary instruments). Therefore, since it is much more precise and less traumatizing to tissue, this technique demands training and practice to find the perfect balance between the practitioner's gesture and the movement speed of the tip.

4. Selectivity of ultrasonic cutting effect

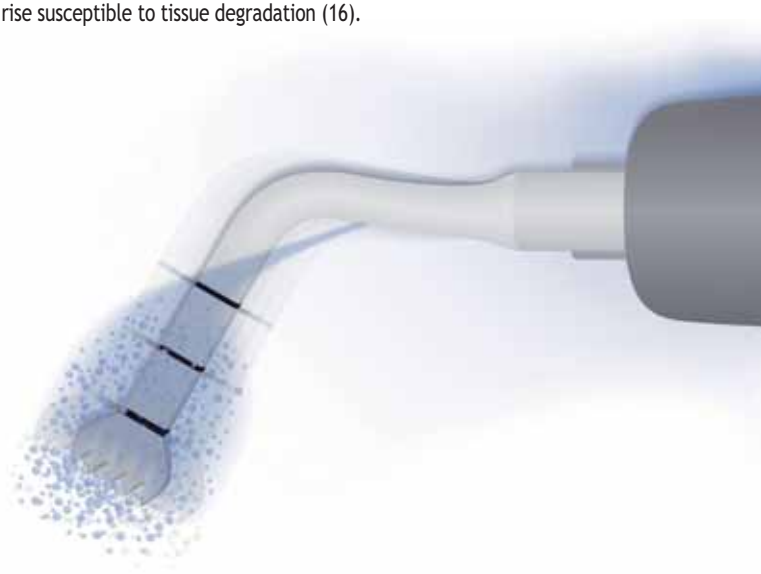
Due to the selected frequencies ranging between 28 and 36 kHz, in Piezotome mode, the tips are active on hard tissue, limiting the risk of soft tissue injury. The generator produces intermittent ultrasonic vibrations which alternate with weaker amplitude, known as the modulated piezo signal. This modulated signal is said to allow tissue relaxation and optimal cell repair for a clean cut and better healing. Finally, it guarantees an incision free of friction and vibration.



In particular, the study of Horton, Tarpley and Jacoway in 1981 (8) demonstrates the cutting precision. The robust tips, associated with limited vibration amplitude, enable very highly precise cutting. Finally, the great maneuverability of the handpiece, combined with the range of tips adapted to each clinical application, allow precise control during all types of treatment.

5. Hemostasis

Due to its irrigation subject to cavitation, the generators have a hemostatic effect on the cutting surfaces (partially owing to the production of nascent oxygen). The cavitation is characterized by the appearance of micro-bubbles when liquid comes into contact with the tip further to ultrasonic vibrations. When imploding, the cavitation bubbles have a caustic effect. This phenomenon allows achievement of optimal visibility of the operative field, limits the blood extravasation, cleans the working zones of bone debris and avoids temperature rise susceptible to tissue degradation (16).



6. Histology

A histological study was performed in 2001 by T. Vercellotti, A. Crovace, A. Palermo, L. Molfetta (18) in order to observe tissue healing mechanisms after having performed cutting lines with a piezoelectric device. Three orthopedic surgeries were carried out on dogs involving ulnar osteotomy, head and neck osteotomy and laminectomy. This study demonstrated an absence of necrosis signs on the cutting surfaces. Furthermore, the presence of living osteocytes exhibited the weak trauma engendered by this new technique. The macroscopic examinations showed the neatness of cutting. Indeed, devoid of pigmentation or visible signs of necrosis, the cutting surface is perfectly smooth.

CLINICAL APPLICATIONS

Developed by the Research and Development Department of SATELEC, the ultrasonic power generators (PIEZOTOME / PIEZOTOME SOLO (LED) / PIEZOTOME 2 / IMPLANT CENTER 2) are designed for delicate operations such as osteotomies, osteoplasties, ridge expansions, or sinus lift.

1. Diagnosis of bone loss

Above all, a general evaluation of the patient status is essential in order to identify his/her previous medical history, physical and psychological needs.

Clinical investigation must be performed to evaluate the extent of bone loss by X-ray (notably panoramic type), tomographies and scanners or three dimensional MRI (Magnetic Resonance Imaging). The practitioner must evaluate bone height and its density by radiography before treatment.

According to the study of Harris D. in 1997 (6), bone resorption can have four principal origins:

- Pathological (periodontal diseases, cysts, etc.).
- Surgical (extraction of embedded canine, apical resection, etc.).
- Congenital (micrognathy, oligodontia, clefts, etc.).
- Physiological (tooth loss, age, pneumatisation of the maxillary sinus).

Bone resorption is a constraint for implant insertion. However, disparities exist because the anterior ridge resorption is four times faster in the mandible compared to the maxilla (3). Bone resorption brings the crestal edge closer to the inferior alveolar nerve in the mandible, and to the sinus cavities in the maxilla. For an implant of 3.75mm in diameter, the quantity of required minimal bone is 4mm transversely and 7mm vertically (15). If the bone height is lower than 6-7mm, a surgical operation of type bone graft or sinus lift will be necessary for insertion of an implant. However, the practitioner will have to encounter different obstacles such as: the inferior alveolar nerve, the maxillary sinus or the nasal fossas according to the location of the future implant.

2. Bone classification

In implantology, the identification of bone volume is mostly based on the classification of Lekholm and Zarb (1985) who have listed four types of bone density (D):

D1
Very high bone density and thick cortical bone.

D2
High bone density and thick cortical bone.

D3
Intermediate bone density, thin cortical bone and dense spongy bone.

D4
Weak bone density, fine or even absent cortical bone and spongy bone.

3. Healing

Bone fracture leads inevitably to a trauma which activates a healing response. Within the first four hours following the operation, the inflammatory reaction induces vasodilation, plasma and leukocytes seepage and an appearance of inflammatory cells contributing to phagocytosis of cellular and tissue debris (such as macrophages). Simultaneously, at the healing site, angiogenesis or formation of a blood clot (containing blood platelets) and new blood vessels can be observed. This revascularization provides nutrition to cells, necessary for their development and proliferation. It is thus particularly important during patient diagnosis, to make sure of the good quality of vascularization. Finally, the weaker the mechanical trauma, the faster the local circulation will be restored (12).

The use of piezoelectric instruments limits the development of trauma.

4. Contraindications

For a favorable progress of the operation, it is important to verify the general status of the patient. The contraindications are the same as for any surgical operation.

However, the use of devices with ultrasound is contraindicated for the bearers of active implants (for both practitioner and patient) such as pacemakers. Furthermore, certain diseases such as cardiopathy (heart disorders), diabetes, bone diseases and patients receiving radiotherapies can be a constraint for an implant placement.
Bone structure validation and circulatory evaluation of the patient are essential elements to ensure efficient graft integration and healing.

CLINICAL PROCEDURES

1. Bone Surgery (BS)

a. Autogenous bone graft

Autogenous bone remains the best choice for bone graft operations. Autogenous graft is defined when the graft is derived from the same patient, as donor and recipient. Both surgical acts (harvest and graft placement), have to be done during the same surgical session. The graft can be procured from various parts of the body where dense cortical bone can be found: such as skull (parietal bone), hip (iliac bone) or certain intraoral sites. The Piezotome handpiece and its tips are specifically intended for small to average harvests from intraoral sites.

Prior to all acts of harvesting or cutting of a bone window, an incision and flap elevation must be performed to have access to the site. It is then essential to preserve a good visibility of the operative field and a good blood supply, by respecting anatomical structures and avoiding unsightly scars. It is highly recommended to clean the bone out of any trace of soft tissue before the use of tips. Because, as previously explained, the tips cut only hard tissues and will not produce the expected effect in presence of soft tissues. The suture is made by a wound closure without tension.

Chin bone harvest

The chin bone allows a bone harvest of about 2cm wide and 3cm long. The central part is preserved in order not to modify the shape of the chin. This operation, performed under local anesthesia, has only moderate operative consequences. However, a risk of mobility disturbance of the chin muscles and nerve lesions, notably labial and incisive, can occur following the operation.

Advantages	Disadvantages
Local anesthesia	Limited bone quantity
Accessibility	Less abundant spongy bone
Rapid healing	Frequent loss of sensitivity of anterior teeth
Moderate post-operative pain	Possible mucosal paresthesia
Limited swelling reaction	

See reference (14).

Ramus bone harvest

Ramus bone is useful when small and average extent of bone is needed. Operative consequences are simple and comparable to those of a wisdom tooth extraction. However, it is important to be careful not to hurt nerves, particularly the inferior alveolar nerve.

Advantages	Disadvantages
Highly abundant spongy bone	More comfortable general anesthesia
Thick cortical bone	Difficult access
Operative consequences similar to that of the third molar extractions	Risk of lesion to the inferior alveolar nerve: scanner necessary
No esthetic impairment	Specific surgical material

See reference (14).

To favor a graft integration on the recipient site, the practitioner must first check the presence of spongy bone, the stability and good integration of the graft. For that purpose, he/she is brought to perform osteoplasties.

Required qualities of the recipient site and the graft

Recipient site	Graft
Intact and free of any infectious lesion	Cortico-spongy block
Existing bone skeleton (scaffold)	Stability
Presence of spongy bone allowing osteosynthesis	No space between the recipient site and the graft
Site preparation	Graft preparation

See reference (14).

b. Osteotomy instruments

Bone Surgery™ (BS) tips, principally intended for performing bone graft, allow cutting, excising and remodeling bone structures without any risk of soft tissue lesions.

Protocol

Having identified the bone deficit, the intraoral harvest site (from chin or ramus bone) must be chosen and the flap performed.

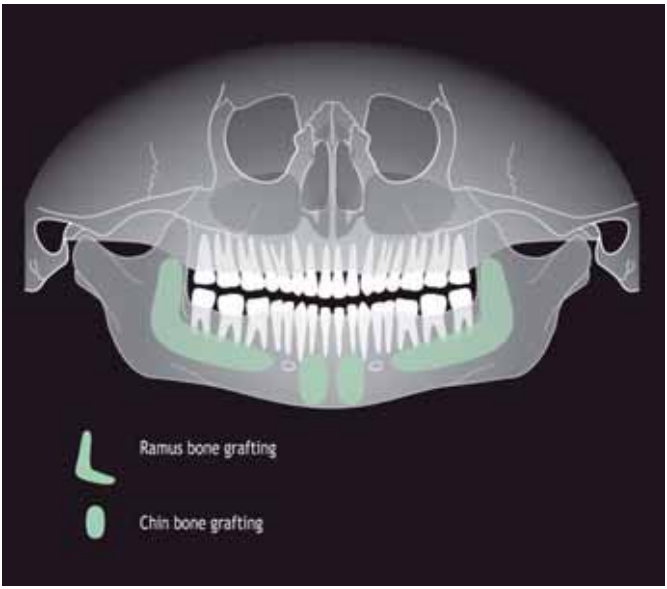
The **recipient site** must be exposed before harvesting the graft in order to measure the bone deficit and anticipate the graft integration.

The **BS1** saw marked every 3mm, creates the lines of **osteotomy**. The angled forms of the **BS2L** and **BS2R** saws facilitate horizontal and vertical cuts during ramus bone harvest. The precise and selective cut of saws limits any risk of soft tissue lesions. Ultrasound favors the cleavage of the bone block and thus the graft harvesting. The use of striking instruments and its consequences for the patient is greatly reduced.

The **recipient site** is then prepared, commonly called **osteoplasty**. The **BS4** and **BS6** tips allow elimination of granulation tissue, leveling of the site (osteoplasty) and collection of bone shavings to be later integrated into the bone filling material. The bone block is then screwed in and the graft edges rounded off with the **BS6** tip or the diamond tips of the **SL** kit (**SL1** or **SL2**). The bone filling is spread and the site is sutured. Healing varies between 3 to 6 months.

The **BS5** tip is especially designed for delicate osteotomies (ridge expansion, premarking during a sinus lift).

The following tip index charts specify the different clinical applications of each one.


Ramus bone grafting
Chin bone grafting

BONE SURGERY 2

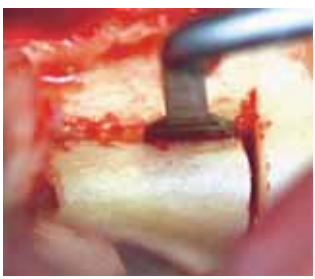
BS1 available for Piezotome

BS1S available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

Ultra-sharp and robust saw, equipped with four specifically sharpened teeth, intended for:
- in-depth cutting of cortical bone in pre-implant surgery,
- surgical orthodontics Piezocision™ (2),
- bone distraction.

Depth of cut: 9mm.

The laser-marker, placed every 3mm, makes it easier to gauge bone deficit and control depth of cut.
This extremely sharp bone saw is particularly effective during chin and ramus bone harvesting.



Piezotome

Recommended modes				Irrigation ml/min
1	2	3	4	40-50

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

BS1 long

Ultra-sharp saw, slim profile, equipped with four specifically sharpened teeth, intended for facilitating ramus grafts.

Depth of cut: 15mm.

The laser-marker, placed at 3, 6, 9, 12 and 15mm, makes it easier to gauge bone deficit and control depth of cut.
This extremely long saw is particularly effective during ramus graft simply by applying the tip all along the graft.

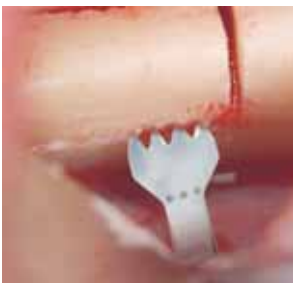
Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

Left-angled bone saw with four teeth, used for cutting the ramus cortical bone.

This tip, specially adapted to the anatomical situation, facilitates the cut of ramus cortical bone. Left oriented, it is used to create vertical and horizontal osteotomy lines on the patient's right mandible.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	40-50

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

BS2R

Right-oriented bone saw with four teeth, used for cutting the ramus cortical bone.

This tip, specially adapted to the anatomical situation, facilitates the cut of ramus cortical bone. Right oriented, it is used to create vertical and horizontal osteotomy lines on the patient's left mandible.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	40-50

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

BS4

Circular scalpel angled at 130°, for osteoplasty and harvesting of bone particles or chips.
Treatments: Ridge osteoplasty, periodontal surgery, cysts exeresis, etc.

During **bone graft**, this tip shapes the recipient site (osteoplasty) in order to ensure the graft stability, facilitating its integration.
Used during **sinus lift**,it collects bone shavings of the vestibular bone window. The aspirated autogenous bone will be harvested in a bone filter to be integrated later into the bone filling material.
In the case of a **cyst**, the **BS4** planes the site until the cystic follicle is perfectly exposed.

PIEZOTOME

Recommended modes				Irrigation ml/min
1	2	3	4	35-40

PIEZOTOME 2 and SOLO (LED) / IMPLANT CENTER 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60

*Not applicable to PIEZOTOME SOLO (LED).

Flat scalpel, for fine osteotomies.
Treatments: ridge expansion, thin osteotomy, distraction, preparation of buccal bone flap on thick cortical terrain prior to sinus lift surgery.

Sharpness and precision characteristics of the **BS5** are undeniable advantages for performing other numerous surgical acts. For instance, it can be used at the very beginning of the surgery to perform a marking line during bone distraction or sinus lift.

Ridge expansion

Pre-marking of the bone window

Piezotome

Recommended modes				Irrigation ml/min
1	2	3	4	35-40

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

BS6

Curved scalpel particularly recommended for osteoplasty.
Treatments: remodeling, curettage and harvesting of bone chips.

An **osteoplasty** tip, the **BS6** cleans the recipient site, smooths surface defects and eliminates adhering periostium (fibrocellular layer) in order to best adapt the recipient site to the graft. It can serve for remodeling the graft to eliminate any secant or aggressive zone and to separate the cortical bone graft from subjacent medullary tissue during grasp of the graft. Finally, it levels the surrounding ridge during ridge expansions.

PIEZOTOME

Recommended modes				Irrigation ml/min
1	2	3	4	35-40

PIEZOTOME 2 and SOLO (LED) / IMPLANT CENTER 2

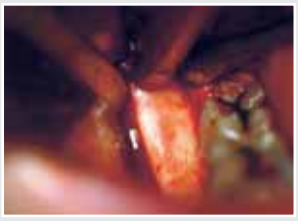
Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60

*Not applicable to PIEZOTOME SOLO (LED).

Instrument sequence

Ramus bone harvest

1

2 

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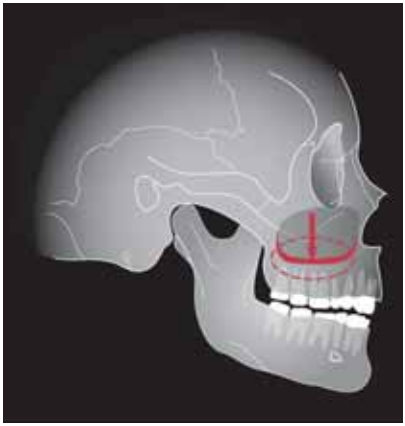
Ramus bone harvest and graft remodeling for filling of bone deficit on tooth 11.

2. Sinus Lift (SL)

a. Lateral sinus lift

The sinus cavity naturally tends to increase its volume with time (see illustration below). Furthermore, the extraction of a tooth situated in the maxillary sinus area entails a loss of bone height (called pneumatisation of the sinus) and a loss of alveolar bone. The placement of an implant in a bone deficit zone can then lead to a membrane perforation. The sinus membrane acts as an immune barrier responsible for the maintenance of the healthy sinus. It is thus necessary to perform a sinus lift by an elevation of the membrane, then by an integration of biomaterials.



For this type of operation, the patient is put under local anesthesia. A flap is then performed and then opened on the antero-lateral wall of the upper maxilla. Different techniques of window cutting can be employed. However, considering the risks of membrane perforation when moving bone window inward into the sinus (Tatum's technique), it is recommended to remove and separate the whole perimeter of bone window fragment.

b. Instruments for lateral sinus lift approach

The **Sinus Lift™ (SL)** kit, consisting of five ultrasonic tips, is specifically designed for sinus lift.

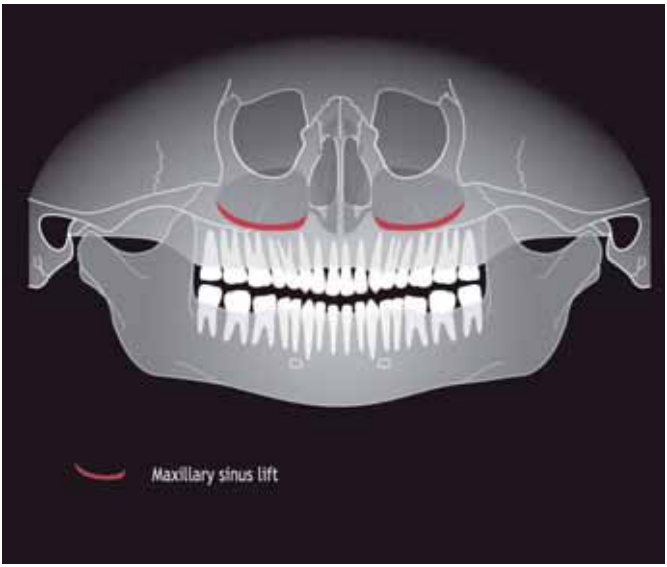
The sinus cavity naturally tends to increase in volume with time. Having identified the bone deficit, a flap must be performed with scalpel under local anesthesia.

The **vestibular bone window** is operated with the **SL1 diamond** tip by a horizontal incision, followed by two vertical lines, then a second horizontal incision. The angles of this window are then smoothed with the **SL1** and/or the **SL2** in order not to damage the sinus membrane.

Once the bone block has been prepared, the **elevation of the membrane** is assured with the **SL3** tip. It is introduced between the cortical bone and the membrane (or the bone block, according to the method) and separates them approximately 2.5mm apart from the edge. The **SL4** and **SL5** tips are then used in apical, mesial and then distal position to elevate the edges deeper. It is important during this operation to keep good contact with the edges of the vestibular bone window.

The **filling of sinus** is then performed. Autogenous bone shavings harvested during the operation can be mixed with biomaterials. The bone filling material is then introduced into the bone window and over the whole site. Before suturing the site, collagen or GORE-TEX® or even VICRYL® membranes can be placed to protect and maintain the filling material. Finally, depending on the case, implants are inserted approximately three months after the operation.

The following tip index charts specify the different clinical applications of each one.


Maxillary sinus lift

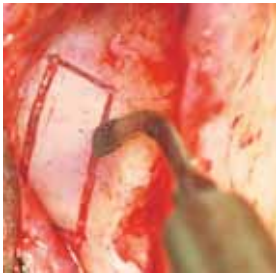
SINUS LIFT 2

SL1

Diamond-coated tip for vestibular bone window cut and for attenuation of sharp angles.

This tip is used to perform bone incisions less aggressive than saws. It is recommended to be used during a vestibular bone window cut and attenuation of the sharp angles to protect the nearby anatomical structures. During its use, the practitioner has to perform a constant (longitudinal) sweeping of the surface to be incised. The **SL1** remodels all the secant bone zones susceptible to damage the sinus membrane or the tissues surrounding the graft.

The marking phase of the bone window can possibly be performed with the **BS5**.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	40-50

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

SL2

Diamond-coated ball tip for smoothing the vestibular bone window and precise osteoplasty.

Ball diameter: 1.5mm. Laser mark every 2mm.

This diamond tip performs very fine bone incisions. It is intended for the vestibular bone window cut (of very thin bone) and precision osteoplasty. The **SL2** remodels all the secant bone zones likely to damage the sinus membrane or the tissue surrounding the graft. It cleans and refines alveolar bone after tooth extraction.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	40-50

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

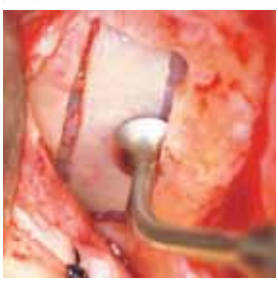
*Not applicable to Piezotome Solo (LED).

SL3

Plateau tip, non-cutting, for sinus membrane elevation on the window's edges.

Plateau diameter: 5mm.

This non-cutting tip is intented for elevating the sinus membrane by approximately 2.5mm on the window edges. During use, it is essential to keep permanent contact between the membrane and the lining bone. Finally, in the case of a cyst, the **SL3** tip separates it from the osseous wall.



Piezotome

Recommended modes	Irrigation ml/min
1 2 **3** **4**	35-40

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 **D4**	1 to 3	50

*Not applicable to Piezotome Solo (LED).

Non-cutting spatula, oriented at 90°, for sinus membrane elevation inside the sinus.

Spatula diameter: 4mm.

This tip is intended for sinus membrane elevation and disengagement of anatomical structures. During use, the practitioner should keep it permanently touching the bone edges. The elevation is undertaken at the apical, mesial then distal parts.
Finally, in the case of a cyst, the **SL4** tip separates it from the osseous wall.

Piezotome

Recommended modes	Irrigation ml/min
1 2 **3** **4**	35-40

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 **D4**	1 to 3	30

*Not applicable to Piezotome Solo (LED).

SL5

Non-cutting spatula, oriented at +/- **135°**, used for sinus membrane elevation inside the sinus and for disengagement of anatomical structures.

Spatula diameter: 4mm.

This tip is used for sinus membrane elevation and disengagement of anatomical structures. During use, the practitioner should keep it in contact with the bone edges. The elevation is undertaken at the apical, mesial then distal parts.
Finally, in the case of a cyst, the **SL5** tip separates it from the osseous wall.

Piezotome

Recommended modes	Irrigation ml/min
1 2 **3** **4**	35-40

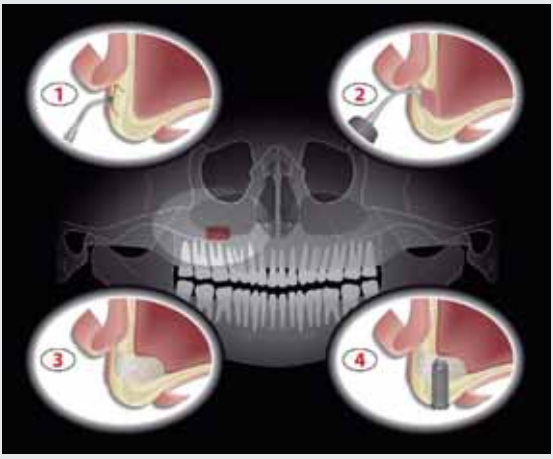
Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 **D4**	1 to 3	30

*Not applicable to Piezotome Solo (LED).

Instrument Sequence

Discarded vestibular bone window



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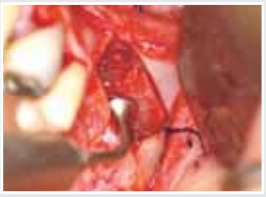
3 

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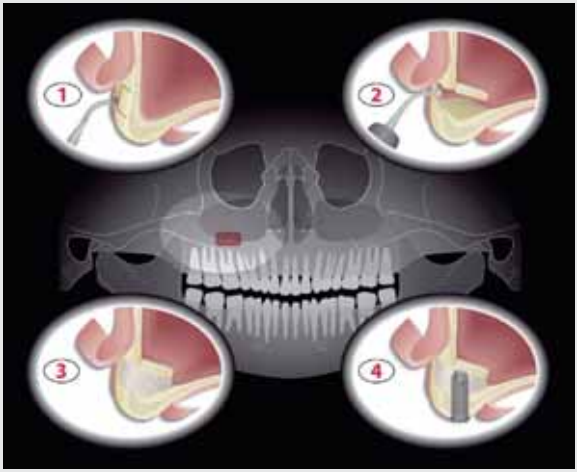
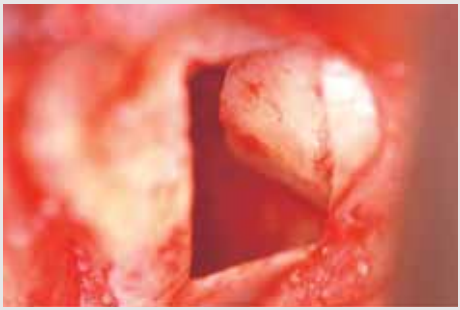
The surgical principle of a sinus lift is as follows: cutting the vestibular bone window, elevating the sinus membrane, filling and suturing the site.

Photos were taken during two operations.

Instrument Sequence

Preserved vestibular bone window





Swinging vestibular bone window towards sinus membrane during a sinus lift.

3. Intralift

a. Sinus lift by the crestal approach

The sinus elevation can be achieved by the lateral or crestal approach. The INTRALIFT™ kit is intended for the latter technique, consisting in using the same path as the implant socket, raising the sinus membrane and placing, if the primary stability permits it, the implant(s) during the same surgery (21).

Introduced by Summers in 1994, this technique used manual osteotomes. Minimally invasive, it is now feasible with the INTRALIFT kit associated with SATELEC ultrasonic power devices. Drilling is done with four diamond coated tips of increasing diameter. The **TKW5** non diamond-coated tip, with internal irrigation, is designed for sinus membrane elevation.

b. Benefits of ultrasonics

Security	The selective cut limits the risk of injury to soft tissues (membranes, arteries...).
Efficiency	Rapid and minimally-invasive technique. Large and homogenous membrane lifting.
Visibility	The cavitation effect allows optimal visibility of the operative field and cleans the working sites of bone debris that could puncture the mucosa.
Comfort	Drill without effort or risk. No need for a mallet.

C. Instruments for crestal sinus lift

Developed for sinus lift by the crestal approach, the INTRALIFT kit makes it possible to perform non invasive surgery in full safety.

1. Reveal Alveolar Crest Bone by a 8x8mm top crest flap or 6mm diameter crestal punch and use an implant pilot drill if the residual bone is more than 3mm. Stop drilling before sinus floor.

2. Pilot drilling with **TKW1** (Ø 1.35mm) in very dense cortical bone when residual bone is less than 3mm. Stop drilling 1mm before reaching the sinus floor bone.

3. Use the cylindrical **TKW2** tip (Ø 2.1mm) to drill, widen the access canal and open the sinus floor to have a direct view on the membrane. Check with unilateral Valsalva-test.

4. Perform a receptacle preparation with **TKW4** (Ø 2.8mm) of 2mm depth (control with the laser marks which are placed every 2mm). If alveolar crest is only 1-2mm receptacle depth should be 0.5mm.

5. Place a collagen sponge in contact with the sinus membrane for additional perforation protection.

6. Insert the **TKW5** tip into the receptacle preparation previously performed, check if **TKW5** is press-fit sealed into the receptacle and activate the ultrasonics for 5 seconds (this will create an augmentation volume of 2.5ml under the sinus membrane). Check floating of sinus-membrane by direct view or by unilateral Valsalva-test.

7. Use the **TKW3** (Ø 2.35mm) to widen the access canal to the sinus membrane prior to plugging bone graft. Because of the selective cut of the ultrasonics and as the membrane has already been fully detached the risk of membrane perforation is almost zero if applied carefully.

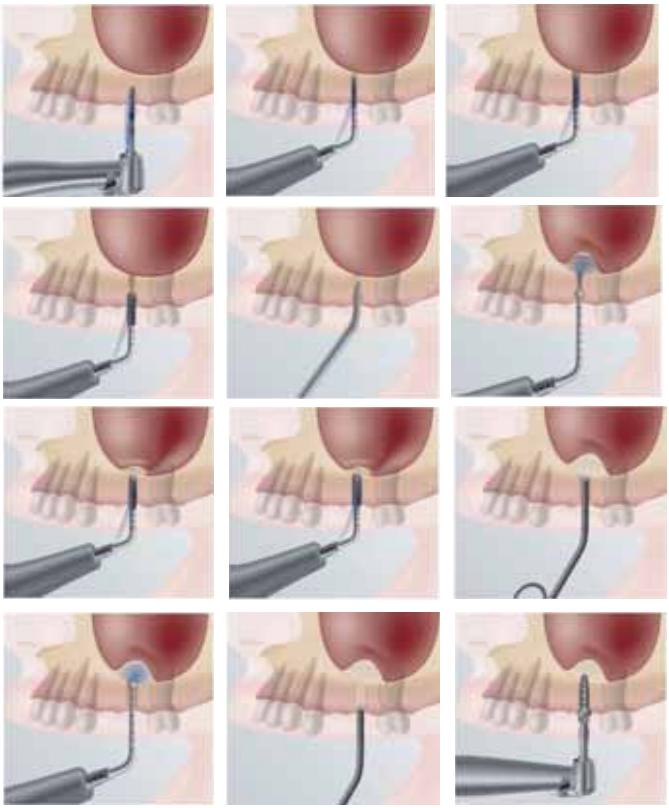
8. Widen even more the canal with the **TKW4** (Ø 2.8mm).

9. Insert the bone grafting material.

10. Perform the "Plug & Spray" technique with **TKW5** for 2-3 seconds if bone graft gets stuck in the canal and/or to disperse the bone graft evenly on the sinus floor.

11. Complete the biomaterial insertion.

12. Place the implant if you have enough primary stability. Take into consideration that the implant will consume 50% of the augmentation volume so insert only 50% of bone graft in order to prevent a membrane rupture during implant insertion



INTRALIFT 2

Conical tip intended for bone drilling.

Diameter: 1.35mm.

Conical (Ø 1.35mm) and diamond-coated tip for pilot drilling. Drill the upper maxilla from the crest to the sinus floor.

Piezotome

Recommended modes				Irrigation ml/min
1	2	3	4	80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	3	100

*Not applicable to Piezotome Solo (LED).

Cylindrical tip intended for bone drilling.

Diameter: 2.1mm.

Cylindrical (Ø 2.1mm) and diamond-coated tip for drilling and fracturing the sinus floor.

Piezotome

Recommended modes				Irrigation ml/min
1	2	3	4	80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	3	100

*Not applicable to Piezotome Solo (LED).

Cylindrical tip intended for bone drilling.

Diameter: 2.35mm.

Cylindrical (Ø 2.35mm) and diamond-coated tip dedicated to drill and widen the access canal to the sinus membrane.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	3	100

*Not applicable to Piezotome Solo (LED).

Flat end tip intended for bone drilling.

Diameter: 2.80mm.

Cylindrical (Ø 2.80mm) and diamond-coated tip intented for the receptacle preparation and widening the access canal to the sinus membrane.

Piezotome

Recommended modes				Irrigation ml/min
1	2	3	4	80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	3	100

*Not applicable to Piezotome Solo (LED).

TKW5

Non-cutting tip for sinus membrane elevation by the crestal approach.

Non cutting tip, that delivers sterile irrigation spray through the end of the tip, used for sinus membrane elevation by means of microcavitation. Tip to be placed in the receptacle preparation for sinus membrane elevation by crestal approach. The membrane elevation is achieved gradually by a successive increase of irrigation flow rate. The **TKW5** can also be used for compacting bone filling materials. Never place the vibrating **TKW5** tip in direct contact with the membrane.

Detachment

Compaction**

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	30-40

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1	30-40

** Compaction < 3 seconds:
Piezotome: mode 2, 10ml/min
Piezotome 2 and Solo (LED)/Implant Center 2: D3 (1 to 3), 10ml/min

*Not applicable to Piezotome Solo (LED).

Instrument sequence

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Photos were taken during two operations.

4. Crest Splitting (CS)

a. Crest splitting technique

The ridge **expansion technique**, introduced for the first time by Bruschi and Scipioni in 1990 (13), allows an implant placement in the ridges originally having deficient thickness. With use of **CS** tips, the vestibular and lingual (or palatal) cortical bones are separated, then the implant can be introduced between both cortical bones.

The **CS** tips can smoothly enlarge the crest, one by one, avoiding the risks of bone breaking.

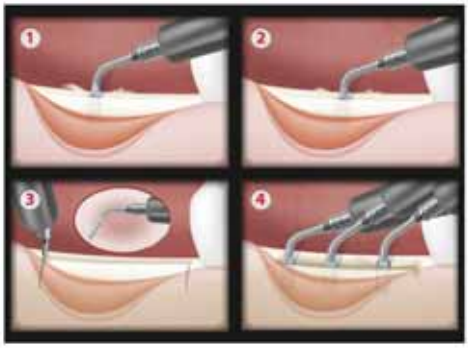
b. Benefits of ultrasonics

Minimally invasive	Thanks to the ultrasonic selective cut, a minimal flap can be performed.
Precision	Tips thinness provide less bone loss.
Security	A progressive and smooth crest enlargement to avoid any bone fracture.

c. Protocol

1. Perform with a traditional scalpel a single top alveolar crest incision and then use the **CS1** ultrasonic tip for a vertical longitudinal pilot osteotomy with 8mm depth. A laser mark every 2mm gives control over the osteotomy until the minimum depth of 7-8mm is reached.
2. Continue your initial lateral expansion with the **CS2** again to a minimum depth of 8mm.
3. With the **CS3**, perform the buccal relief osteotomies (discharge osteotomies at mesial and distal end of the longitudinal osteotomy), to a minimum depth of 8mm equal to the depth of the longitudinal osteotomy.
4. Start your bone expansion with the **CS4** tip. Tip thickness: 1.80mm at 8mm.
5. Continue the enlargement with the **CS5** tip. Tip thickness: 2.75mm at 8mm.
6. Finalize the expansion with the **CS6** tip. Tip thickness: 3.75mm at 8mm.
7. For a **one step surgery**: insert the implant(s) and fill gaps with bone graft material and close mucosa with adaptive sutures.

   For a **two step surgery**: fill the expanded osteotomy with bone graft material and perform adaptive sutures. Insert the implant(s) after a healing period of 3 to 5 months.



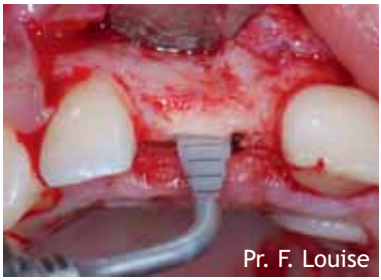
CREST SPLITTING

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

CS1

Fine tip dedicated to pilot osteotomy up to 8mm of depth.

Thickness: 0.55mm.



Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 Mandible	D3 Maxillary	D4	1 to 3	80-100

*Not applicable to Piezotome Solo (LED).

CREST SPLITTING

Scalpel

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

Tip dedicated to the second osteotomy up to 8mm of depth.

Thickness: 0.85mm.

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 *Mandible*	D3 *Maxillary*	D4	1 to 3	80-100

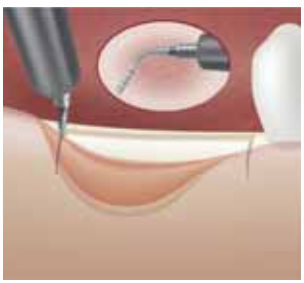
*Not applicable to Piezotome Solo (LED).

CREST SPLITTING

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

Scalpel used for the discharges incisions in mesial and distal sides, always up to 8mm of depth.

Thickness: 0.5mm.



Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 Mandible	D3 Maxillary	D4	1 to 3	80-100

*Not applicable to Piezotome Solo (LED).

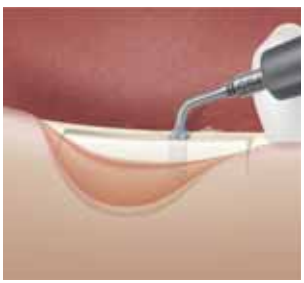
CREST SPLITTING — Expander

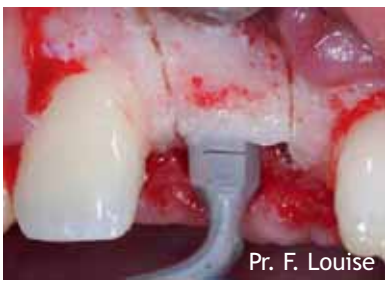
Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

CS4

Conical tip for bone expansion.

Tip thickness: 1.80mm at 8mm.





Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 Mandible	D3 Maxillary	D4	1 to 3	80-100

*Not applicable to Piezotome Solo (LED).

CREST SPLITTING

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

CS5

Conical tip for bone expansion.

Tip thickness: 2.75mm at 8mm.

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 Mandible	D3 Maxillary	D4	1 to 3	80-100

*Not applicable to Piezotome Solo (LED).

CREST SPLITTING — Expander

Available for Piezotome 2 / Piezotome Solo (LED) / Implant Center 2

CS6

Conical tip for bone expansion.

Tip thickness: 3.75mm at 8mm.

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2 Mandible	D3 Maxillary	D4	1 to 3	80-100

*Not applicable to Piezotome Solo (LED).

Instrument sequence

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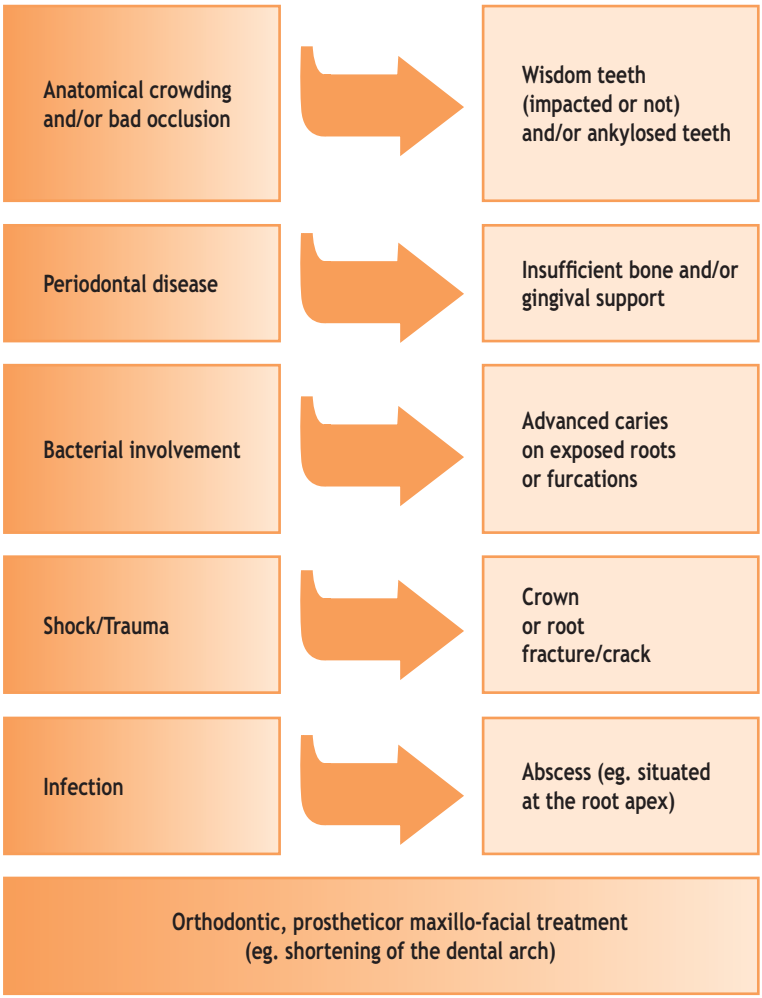
Photos taken by TKW Research Group

5. Extraction

a. Causes and consequences


Anatomical crowding and/or bad occlusion
Wisdom teeth (impacted or not) and/or ankylosed teeth
Periodontal disease
Insufficient bone and/or gingival support
Bacterial involvement
Advanced caries on exposed roots or furcations
Shock/Trauma
Crown or root fracture/crack
Infection
Abscess (eg. situated at the root apex)
Orthodontic, prostheticor maxillo-facial treatment (eg. shortening of the dental arch)

The extraction of a tooth leads to an inevitable loss of hard tissue (in height and thickness) and soft tissues. Any delay in treatment presents a risk of engendering such bone loss that an implant placement can only be performed after pre-implant surgery to restore the necessary bone volume. Two approaches are currently used: conventional or delayed post-extraction implant placement and immediate post-extraction implant placement.

b. Immediate or delayed implant placement

An extraction causes anatomical disorganization. Conventional delayed post-extraction implant placement favors osseointegration. The implant is then placed approximately two months after the extraction and the prosthetic phase will be performed three to six months after the implant placement.

Advantages	Disadvantages
Reliable technique advised in areas where esthetics are a priority.	Multiplication of surgical interventions: 1 - Extraction 2-3 - Implant placement and/or prosthetic phase
	Risk of post extraction bone loss.

Immediate post-extraction implant placement considerably reduces the time and the cost of treatment.

Advantages	Disadvantages
Treatment time and cost reduction.	Non global technique.
Fewer interventions.	Minimum primary stability necessary = 5mm.
Limited bone resorption.	Post implant bone resorption must be evaluated beforehand.
Less drilling stages.	Only possible for type I and II[1] bone density.

After the immediate placement of 1925 implants between 1988 and 2004, Wagenberg (20) obtains an overall success rate of 96%. This technique of extraction and immediate implant placement can thus be recognized as reliable.

c. Benefits of ultrasonics

The use of ultrasonic instruments is much **less traumatizing** for the patients and **preserves the bone tissue** essential for osseointegration. Inserted between the cementum and the periodontal ligament of the tooth, the tips will widen the ligamental space. Thus separated from its attachment system, the tooth can be removed **rapidly and with a less traumatic luxation**. The alveolar bone edge can be kept intact since the tip essentially acts on the tooth and not on the bone. An alveolectomy is therefore avoided.

Less aggressive than cutting burs mounted on rotary instruments, the risk of involuntarily damaging the bone septum, which could harm the gingival papilla, is avoided. Without inertia, these extraction tips limit the risk of lesions to adjacent teeth and roots.

(1) Classification of Lekholm and Zarb

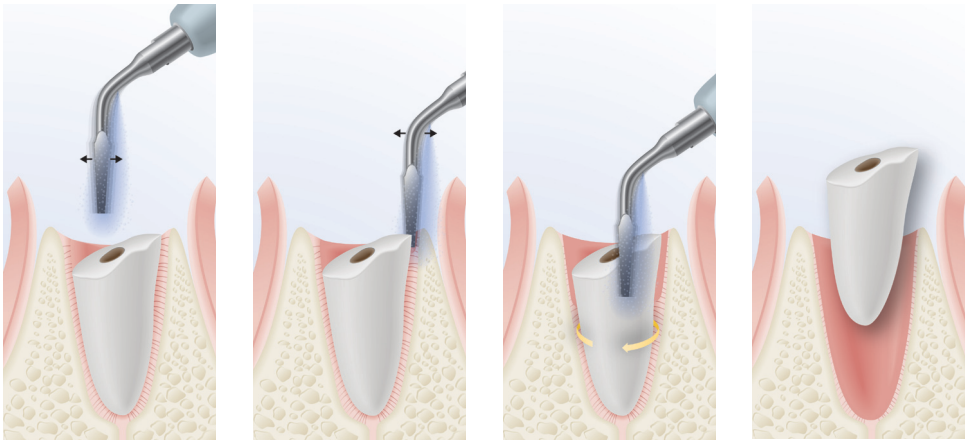
The ultrasonic tips, active on hard tissue and **non-active on soft tissues**, offer the practitioner **greater safety** in the presence of such anatomical elements as the inferior mandibular nerve, lingual nerve, antral artery, sinus membranes, etc. Indeed, the frequency modulation renders the tips **harmless to surrounding soft tissues** (mucosa).

d. Syndesmotomy instruments

Usage guidelines according to Dr. Gagnot's recommendations (11):

- The tip must be activated before its insertion in the periodontal space.
- The tip must be placed parallel to the root.
- Perform a to-and-fro movement towards the apex.
- It is important not to exert a lever effect with the tips.

60-80
Irrigation$^{ml/min}$



Schematic representation courtesy of Dr. Gagnot G.

Ultrasonic periotome intended for syndesmotomy and periradicular osteotomy.

Length of active part: 9mm.

This tip can be inserted deeply and with great care, along the periodontal ligament, between the root and the alveolar bone.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

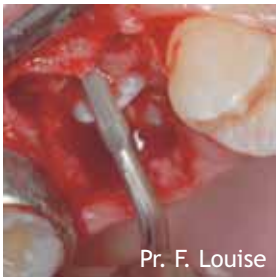
*Not applicable to Piezotome Solo (LED).

LC1 90°

Oriented at 90°, the active part of the tip can easily reach the difficult to access areas.

Length of active part: 9mm.

This ultrasonic periotome facilitates widening of the periodontal space in the interproximal, lingual and distal areas of molars.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

LC2

The particularly slim LC2 allows access to the tight spaces between the root and the alveolar bone without risk of damaging cortical bone.

Length of active part: 10mm.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

LC2L

Oriented at 45° to the left, the **LC2L** facilitates access to the posterior areas. The tip's slimness respects the morphology of cortical bone and offers working comfort in the sectors with reduced visibility.

Length of active part: 10mm.

PIEZOTOME

Recommended modes				Irrigation ml/min
1	2	3	4	60-80

PIEZOTOME 2 and SOLO (LED) / IMPLANT CENTER 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60-80

*Not applicable to PIEZOTOME SOLO (LED).

LC2R

Oriented at 45° to the right, the **LC2R** facilitates access to the posterior areas. The tip's slimness respects the morphology of cortical plate and offers working comfort in the sectors with reduced visibility.

Length of active part: 10mm.

Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

Ninja™

This **saw-tooth tip with double cutting** surfaces is endowed with a laser marker every 3mm, to evaluate depth or cutting thickness. It is particularly effecient for hemisections and root amputations. It is also indicated to split impacted molars during extraction.

Length of active part: 9mm.

PIEZOTOME

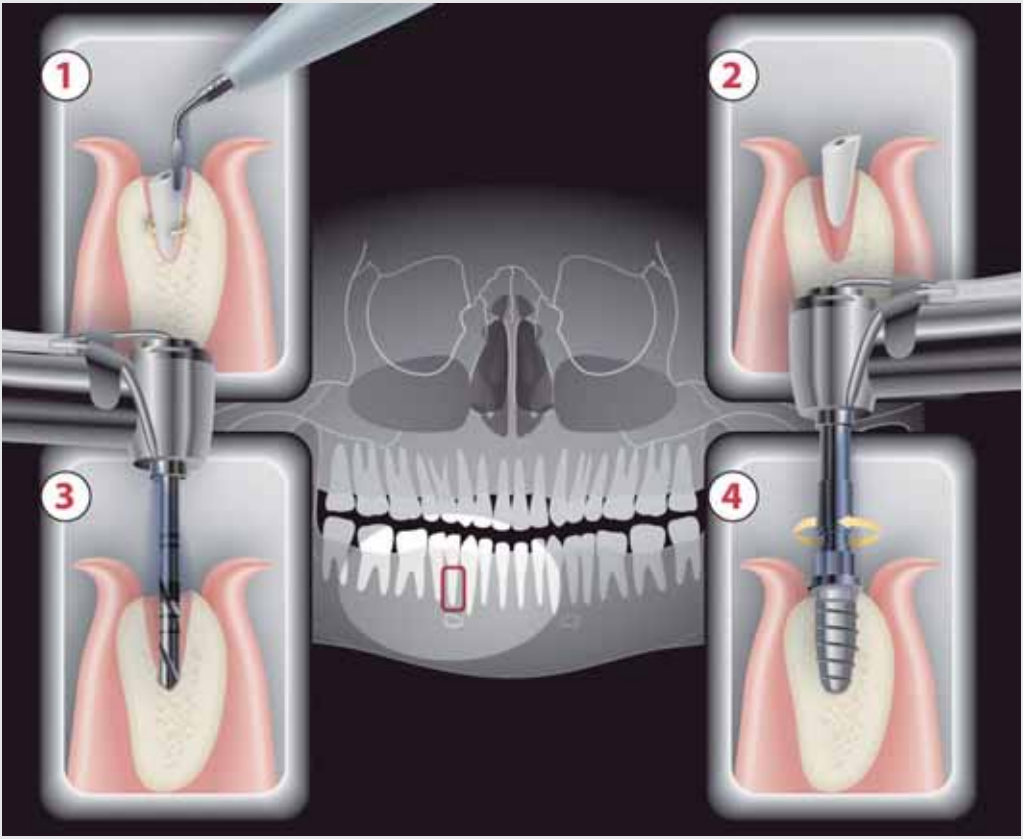
Recommended modes					Irrigation ml/min
1	2	3	4		60-80

PIEZOTOME 2 and SOLO (LED) / IMPLANT CENTER 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60-80

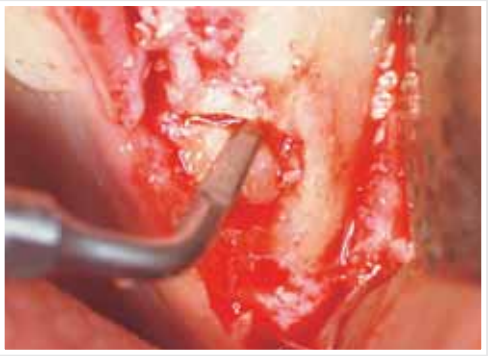
*Not applicable to PIEZOTOME SOLO (LED).

Instrument sequence



Instrument sequence

1



2

3

Using the LC1 around the root to facilitate the root avulsion.

6. Crown Extension (CE)

a. Crown lengthening technique

The aim of crown lengthening techniques (surgical or orthodontic) is to increase the clinical crown height of a tooth planned for a conservative or prosthetic restoration.
The indications for crown lengthening are many:

- Esthetics
  - Gingival hyperplasia
  - Poor gingival contour
- Bacterial destruction
  - Sub-gingival caries
- Accident
  - Crown or root fractures or cracks
- Pathology - occlusion
  - Bruxism
  - Poor occlusion
- Iatrogenic factors
  - Prosthesis which does not respect the biologic width of the cervical margin, perforation, etc.

b. Biologic width

The biologic width as defined by Gargiulo and al. (1961) is measured from the bottom of the gingival sulcus to the alveolar crest. This length is approximately 2.04mm. The mean depth of the gingival sulcus is 0.69mm. The sum of these two figures, rounded off to 3mm, constitutes the space occupied between the summit of the gingival margin and the alveolar crest, the pre-prosthetic surgical space to be preserved.
Respect of the biologic width is essential during treatment and restorative or prosthetic procedures. Not respecting it can engender periodontal lesions such as gingivitis, gingival recession and bone resorption. In order to increase the clinical crown height and restore a healthy physiology, the alveolar crest must be apically positioned at 3mm with regard to the apical finish line of the preparation. The biologic width can therefore physiologically be organized while the access to the cervical finish line of the preparation is improved. The alveolar crest level will determine the final position of the marginal gingiva.

c. Benefits of ultrasonics

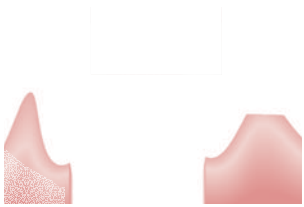
Precision	Regular and controlled movement. Tips slimness guarantees the bone integrity of the adjacent teeth.
Cutting selectivity	Inactive on gingiva. Limits the lesion of periodontal ligament and fibers.
Visibility	Reaches difficult areas of access. Rapid restitution of the necessary biologic width (CE3).
Comfort	Cavitation phenomenon provides an optimal visibility.

Specially developed for this type of procedure, the **BS6** tip and three diamond-coated Crown Extension tips are designed for ostectomy (bone removal) and osteoplasty (bone reshaping). The length of the diamond-coated active part of the **CE3** dedicated to ostectomy is calibrated at 5mm thus allowing a rapid re-establishment of the necessary biologic width (laser mark at 3mm). A few millimeters of the root will be exposed by removal of bone to lengthen the clinical crown.

BS6

Curved scalpel particularly effective for substancial osseous reshaping.

This tip is used to perform osteoplasties and reshaping of the bone not assuring the tooth support. It can also be used to mark a prosthetic reference point on enamel, if needed, where osteoplasty will begin.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	35-40

Piezotome 2 and Solo (LED) / Implant Center 2

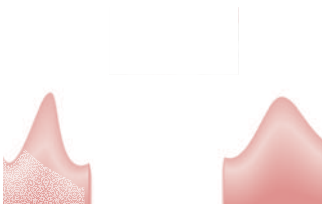
Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60

*Not applicable to Piezotome Solo (LED).

Diamond-coated spherical tip designed for osteoplasty of bone margins.

Ball diameter: 1.75mm (with diamond coating).

Diamond-coated spherical tip designed particularly for osteoplasty in oral and palatal zones, the **CE1** is used on bone tissue not assuring the tooth support. It will be particularly suitable for osseous reshaping over large areas as well as reducing exostosis or osseous irregularities.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

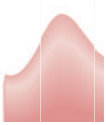
Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

Diamond-coated spherical tip designed for osteoplasty of bone margins.

Ball diameter: 1.20mm (with diamond coating).

This diamond-coated tip is particularly designed for osteoplasty in interproximal zones. Its extremely small diameter facilitates very precise osseous reshaping. The **CE2** is used notably to recreate a good interproximal morphology, thin out bone margins, etc.



Piezotome

Recommended modes	Irrigation ml/min
1 2 3 4	60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes	Fine settings*	Irrigation ml/min
D1 D2 D3 D4	1 to 3	60-80

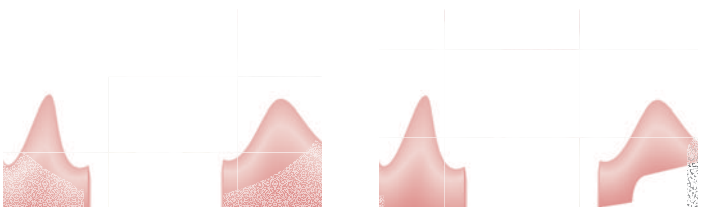
*Not applicable to Piezotome Solo (LED).

Diamond-coated cylindrical tip designed for delicate osteotomies.

Extent of the diamond-coated active part: 5mm.

Diameter of the active zone: 1.20mm.

For a fast restoration of the biologic width (laser mark placed at 3mm). Used perpendicularly or parallel to the bone, this tip is designed for ostectomies of the tooth-supporting bone in interproximal and oral (vestibular) and palatal periradicular zones.



Piezotome

Recommended modes					Irrigation ml/min
1	2	3	4		60-80

Piezotome 2 and Solo (LED) / Implant Center 2

Recommended modes				Fine settings*	Irrigation ml/min
D1	D2	D3	D4	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

Instrument sequence

1

2

3

4

5

6

7

8

Crown lengthening with full-thickness flap following the fracture of a lateral incisor (n° 12).

Instrument sequence

1

2

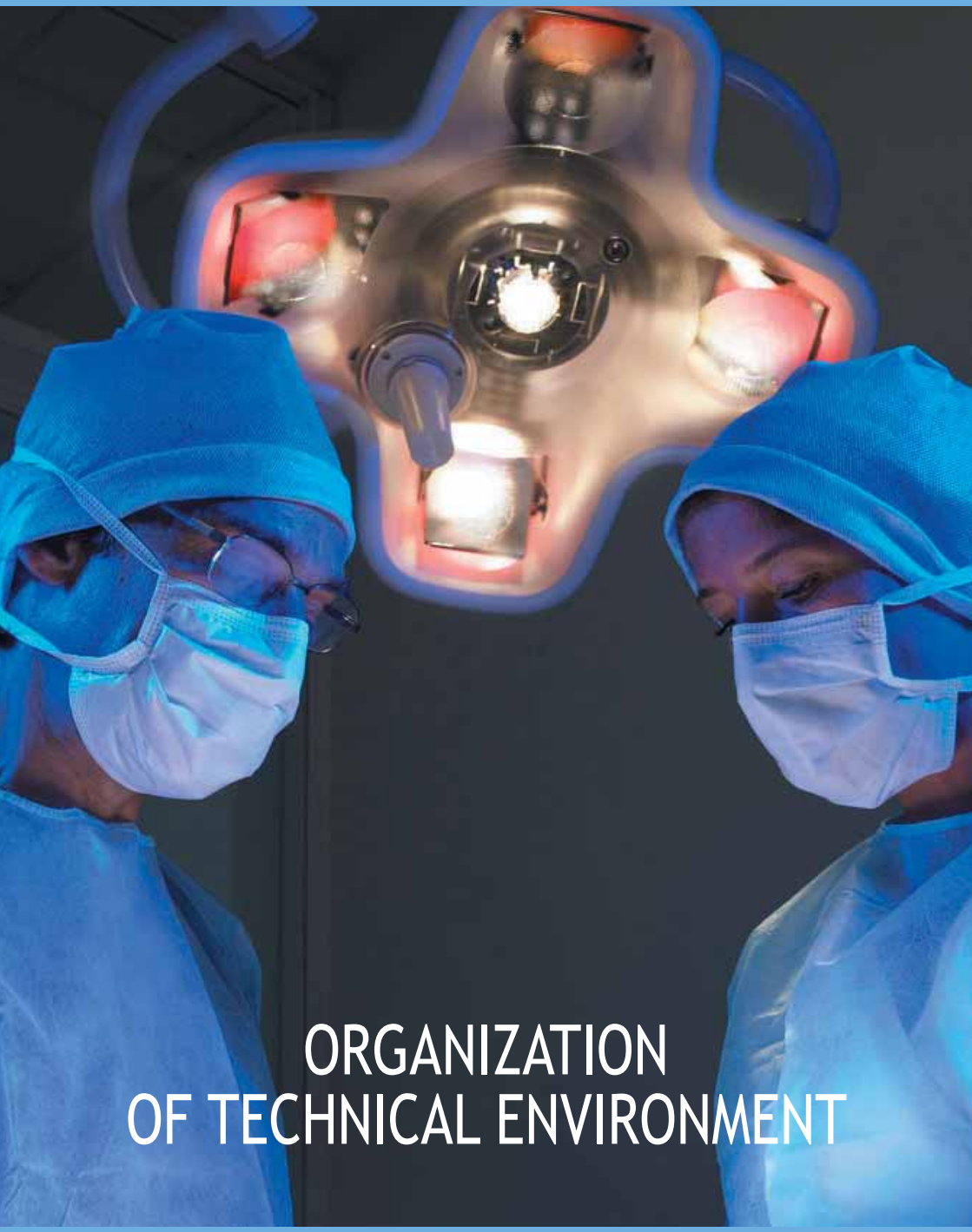
3

4

5

6

Crown lengthening pre-prothesis with esthetic goal.



ORGANIZATION OF TECHNICAL ENVIRONMENT

1. Packaging of the generators and their accessories

Delivered non-sterile, various packages (BS*, SL**, Intralift, CS***, Extraction, CE****) consist of a sterilization box, a handpiece connected to its cord, a dynamometric wrench and a tips support. Before performing an operation, it is necessary to perform a cycle of sterilization.

2. Operating zone organization

Generators can be placed on a mobile Newtron or Implant Center cart. The shelves allow a combination of a piezoelectric generator (Piezotome / Piezotome Solo LED / Piezotome 2 / Implant Center 2) and a high frequency electrosurge (Servotome®).

The irrigation line is connected to the handpiece, clipped with the cord, the cassette placed in the pump and finally the perforator is inserted into a bottle or a pouch of sterile solution.

Tips supports

Prior to the operation, it is advised to place a bridge table above the patient. The stainless steel support and its tips maintained by silicone rings facilitating their grip can be easily decontaminated, sterilized and placed on this bridge table.

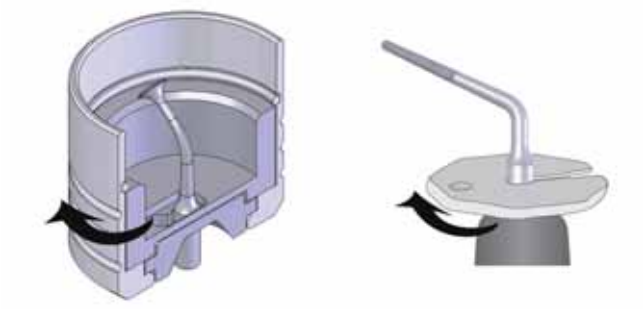
* Bone Surgery, osteotomy
** Sinus Lift
*** Crest Splitting
**** Crown Extension

Handpiece support

It is also recommended to install the handpiece support on the bridge table. The handpiece mounted with its tip can be presented with the head at the top of the support (1). At the end of the operation, the PIEZOTOME handpiece can be introduced upside-down on its support, over a kidney dish (2).

Dynamometric wrench

The dynamometric wrench allows tip changes as necessary. Having screwed the tip on the handpiece transducer, the practitioner can interlock the wrench and tighten at 90° past abutment. The longer tips that do not fit in the dynamometric wrench can be changed by using the universal flat wrench (see illustration below).



3. Cleaning, Decontamination and Sterilization

After surgery, it is important to follow the procedure of decontamination and re-packaging of the device as well as their accessories.

The irrigation line must be purged in distilled water after each operation to eliminate remaining physiological serum. Accessories such as tips support, tips and wrench must be disinfected, decontaminated and sterilized.

The sterilization box can follow a process of physical (brushing) and chemical (detergent) cleaning. Furthermore, cassettes and trays can be placed in a mechanical cleaning device.

Piezotome 2 handpiece:

The handpiece's extremity can be completely unscrewed, facilitating access to and cleaning of the amplifier.
The light guide and the LED ring of the Piezotome 2 handpiece are accessible for optimum cleaning.
It is imperative to remove each item (handpiece, nosecone, light guide, and LED light ring) before cleaning, decontamination and sterilization.

Protocol:

Manual method	Automatic method
Rinse / brush each element in a current cold water, remove dirt.	Rinse / brush each element in a stream of cold water, remove dirt.
Immerse the items in a cleaning solution or alkaline enzyme.	
Rinse under cold running water.	Hand wash each piece in a cleaning solution or alkaline enzyme.
Clean / decontaminate manually each element in a cleaning solution or alkaline enzyme.	Rinse under cold running water.
Rinse thoroughly with distilled water.	Pass only the nose of the handpiece in an ultrasonic tank.
Hand washing in a solution at pH neutral.	Rinse nose under cold running water.
Rinse with deionized or purified water.	Put each item in a washer / disinfector.
Dry.	Packaged and sterilized in an autoclave according to current standards.
Packaged and sterilized in an autoclave according to current standards.	

Maintenance

1. Instruments and accessories

Tips

Surgical tips designed for the first generation of Piezotome and Implant Center cannot be used with Piezotome Solo (LED) / Piezotome 2 / Implant Center 2, high power generators, and vice versa.

Wear of tips must be regularly checked by the user. A tip with dulled active part must be changed. Diamond tips must be replaced when the active diamond part becomes smooth and shiny. In anticipation of tip wear, it is recommended to sterilize a second tip kit in advance. Furthermore, to prolong their efficiency and precision, it is important to avoid dropping them.

For further details, please refer to the relevant kit user's manual.

Piezotome handpiece

Before each operation, it is recommended to check the integrity of the handpiece cord. Unscrewing the handpiece extremity allows access to the sealed joint as well as to the screw thread (zone of tip screwing) and thus allows checking for their wear status. The sealed joint ordered through your local retailer can be easily changed.

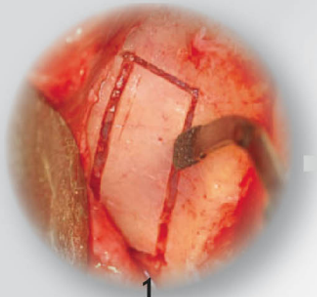
For further details, please refer to the relevant user's manual.

2. Generator

After each operation, it is necessary to check the integrity of power cords, the footswitch and handpieces. The whole generator can be cleaned with disinfectant wipes. It is however important to quickly mop up liquids which might penetrate into the device during the decontamination procedure.

For further details, please refer to the user's manual of your device.

Cleaning/disinfection automatic cycle



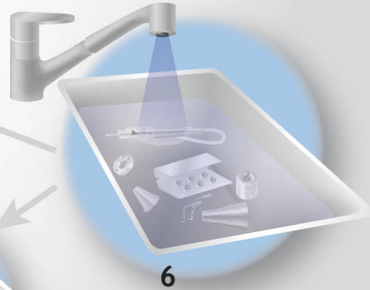
1
Surgery

2
Purge

3
Sort instruments

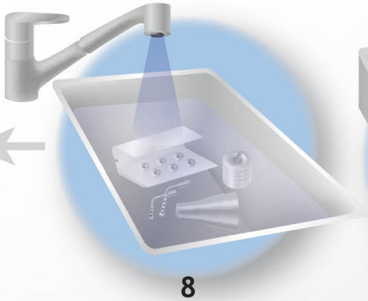
4
Rinse, brush

5
Clean, decontaminate, brush
(enzyme solution or alkaline)

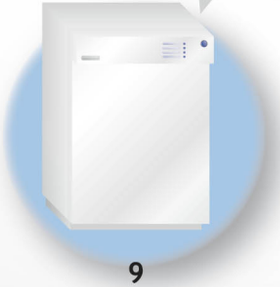


6
Rinse

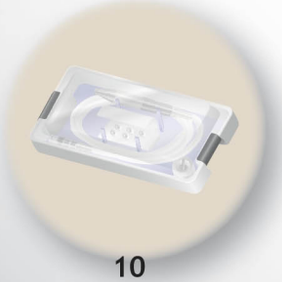
7
Ultrasonic bath
(enzyme solution or alkaline)



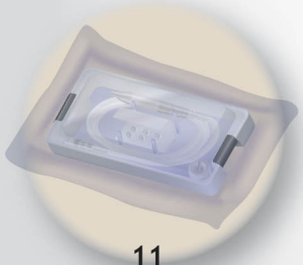
8
Rinse



9
Mechanical
cleaning device

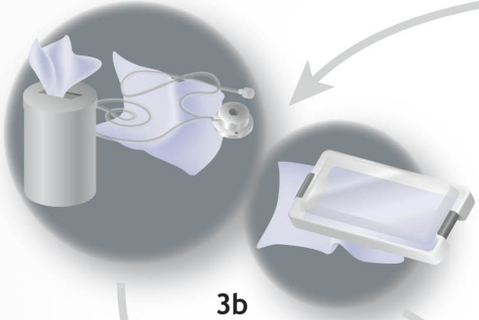


10
Assemble instruments



11
Place in pouch

12
Autoclave



3b
Clean with wipes

3a
Discard perforator

Summary PIEZOTOME

Piezo•Ultrasonic•Surgery•Unit

Tips	Maximum recommended modes	Irrigation ml/min
BS1	1 2 3 4	40-50
BS2L	1 2 3 4	40-50
BS2R	1 2 3 4	40-50
BS4	1 2 3 4	35-40
BS5	1 2 3 4	35-40
BS6	1 2 3 4	35-40
SL1	1 2 3 4	40-50
SL2	1 2 3 4	40-50
SL3	1 2 3 4	35-40
SL4	1 2 3 4	35-40
SL5	1 2 3 4	35-40

Summary PIEZOTOME

Piezo•Ultrasonic•Surgery•Unit

Tips	Maximum recommended modes				Irrigation ml/min
TKW1	**1**	2	3	4	80
TKW2	**1**	2	3	4	80
TKW3	**1**	2	3	4	80
TKW4	**1**	2	3	4	80
TKW5	1	**2**	**3**	4	30-40
LC1	**1**	**2**	3	4	60-80
LC1 90°	**1**	**2**	3	4	60-80
LC2	**1**	**2**	3	4	60-80
LC2L	**1**	**2**	3	4	60-80
LC2R	**1**	**2**	3	4	60-80
NINJA™	**1**	**2**	3	4	60-80
CE1	**1**	2	3	4	60-80
CE2	1	**2**	3	4	60-80
CE3	**1**	2	3	4	60-80

Summary

PIEZOTOME Piezo.Ultrasonic.Surgery.Unit SOLO LED

PIEZOTOME 2 Piezo.Ultrasonic.Surgery.Unit

IMPLANTCENTER 2 Piezo • Ultrasonic • Surgery & Implantology Unit

Tips	Maximum recommended modes	Fine setting*	Irrigation ml/min
BS1S	**D1** D2 D3 D4	1 to 3	60
BS1L	**D1** D2 D3 D4	1 to 3	60
BS2L	**D1** D2 D3 D4	1 to 3	60
BS2R	**D1** D2 D3 D4	1 to 3	60
BS4	**D1** D2 D3 D4	1 to 3	60
BS5	D1 D2 **D3** D4	1 to 3	60
BS6	**D1** D2 D3 D4	1 to 3	60
SL1	**D1** D2 D3 D4	1 to 3	60
SL2	**D1** D2 D3 D4	1 to 3	60
SL3	D1 D2 D3 **D4**	1 to 3	50
SL4	D1 D2 D3 **D4**	1 to 3	30
SL5	D1 D2 D3 **D4**	1 to 3	30
TKW1	D1 **D2** D3 D4	3	100
TKW2	D1 **D2** D3 D4	3	100
TKW3	D1 **D2** D3 D4	3	100
TKW4	D1 **D2** D3 D4	3	100

*Not applicable to Piezotome Solo (LED).

Summary

PIEZOTOME Solo LED · PIEZOTOME 2 · IMPLANTCENTER 2

Tips	Maximum recommended modes	Fine setting*	Irrigation ml/min
TKW5	D3	1	30-40
CS1	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
CS2	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
CS3	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
CS4	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
CS5	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
CS6	D2 (Mandible), D3 (Maxillary)	1 to 3	80-100
LC1	D1	1 to 3	60-80
LC1 90°	D1	1 to 3	60-80
LC2	D1	1 to 3	60-80
LC2L	D1	1 to 3	60-80
LC2R	D1	1 to 3	60-80
NINJA™	D1	1 to 3	60-80
CE1	D1	1 to 3	60-80
CE2	D2	1 to 3	60-80
CE3	D1	1 to 3	60-80

*Not applicable to Piezotome Solo (LED).

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